

## Case Report

# Laparoscopic Partial Adrenalectomy for Bilateral Cortisol-secreting Adenomas

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Bilateral cortisol-secreting adenomas are a rare cause of Cushing's syndrome. We report a case of a 35-year-old woman who presented with ACTH-independent Cushing's syndrome and bilateral adrenal adenomas. Adrenal venous sampling confirmed both adenomas to be hyper-secreting cortisol. She underwent bilateral laparoscopic adrenalectomy; total right and partial left adrenalectomies. At 2-year follow-up, she is maintained on low-dose fludrocortisone and hydrocortisone, and without recurrence of hypercortisolism. Laparoscopic partial adrenalectomy is a feasible option for this rare condition; however, long-term follow-up is needed to determine her total independence from steroid usage. [*Asian J Surg* 2007;30(2):154–7]

**Key Words:** adrenal tumour, Cushing's syndrome, hypercortisolism, laparoscopy, subtotal adrenalectomy

## Introduction

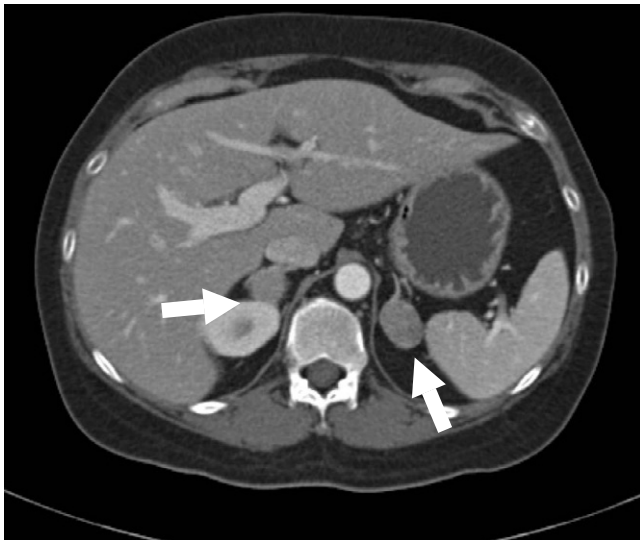
The three most common causes of Cushing's syndrome are corticotrophin (ACTH)-producing pituitary tumours (Cushing's disease), ectopic ACTH secretion by nonpituitary tumours, and cortisol-secreting adrenal adenomas or adrenal carcinomas. The latter group is classified as ACTH-independent Cushing's syndrome. Most adrenal adenomas are solitary whereas bilateral cortisol-secreting adenomas are rare conditions. We present a young female patient with bilateral adrenocortical tumours causing Cushing's syndrome and who underwent successful laparoscopic partial adrenalectomy.

## Case report

A 35-year-old female presented with weight gain, easy bruising, a bloated face and leg swelling. Her blood pressure was 160/110 mmHg, she was overweight at 57 kg (body mass index [BMI] of 25), and she had puffy eyelids

with multiple facial and neck acne, hirsutism, hypertrichosis, supraclavicular fat pad, abdominal striae and bilateral pedal oedema. Her blood count, electrolyte profile, liver and thyroid functions were normal. The blood sugar level was normal and she had hypercholesterolaemia. The 24-hour urine free cortisol was elevated at 1,116 nmol/day (normal range, 59–413 nmol/day). Baseline 4 pm serum cortisol was 491 nmol/L (normal range, 46–389 nmol/L) and ACTH was <2 pmol/L (normal range, 0.0–10.2 pmol/L), and there was no suppression of serum cortisol on low-dose and high-dose dexamethasone suppression tests. These tests confirmed ACTH-independent Cushing's syndrome consistent with an adrenal cause. Pheochromocytoma and primary hyperaldosteronism were excluded from normal biochemical test results. Abdominal computed tomography (CT) scan showed bilateral adrenal tumours with well-defined margins, the right adrenal tumour measured 1.8 cm while the left measured 2.2 cm in their maximum diameters (Figure 1). Adrenal venous sampling was performed. The results (Table) indicated nonlateralization

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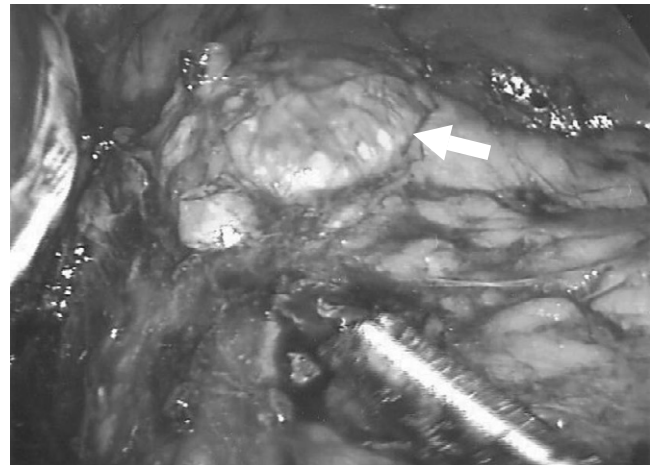
**Figure 1.** Abdominal computed tomography shows bilateral adrenal tumours (arrows).

**Table.** Results of adrenal venous sampling

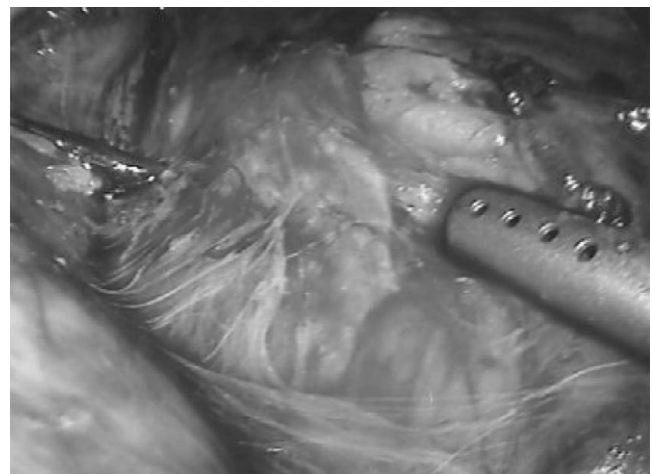
	Left adrenal vein	Right adrenal vein	Inferior vena cava
Cortisol (nmol/L)	1,560	7,290	608
Aldosterone (pmol/L)	645	3,175	107
Cortisol to aldosterone ratio	2.42	2.30	5.70

of the test to either side, confirming that both adenomas were secreting cortisol.

The patient underwent bilateral transperitoneal laparoscopic adrenalectomy. The right side was approached first with the patient in the left lateral position. Two 10-mm and two 5-mm ports were inserted along the right subcostal region. A fan retractor was used to lift the undersurface of the liver. This manoeuvre exposed the adrenal gland and the peritoneum over it was incised using the ultrasonic dissector (Harmonic scalpel®; Ethicon, Johnson & Johnson, Cincinnati, OH, USA). As the tumour was located in the centre of the right adrenal gland, partial adrenalectomy was not possible. Hence, total adrenalectomy was performed after ligation of the short adrenal vein with clips and division of the vein with scissors. The adrenal tumour was removed in a specimen retrieval bag. The patient was then re-positioned in the right lateral position, and a 10-mm port and two 5-mm ports were inserted along the left subcostal area. The spleen and pancreatic tail were mobilized medially to expose the adrenal gland in the retroperitoneal region. As the tumour was located in the upper part of the gland,



**Figure 2.** Left adrenal tumour located in the upper part of the adrenal gland (arrow).



**Figure 3.** Residual left adrenal gland after laparoscopic partial adrenalectomy.

partial adrenalectomy was possible and this was accomplished using the ultrasonic scalpel to excise the tumour with a 1-cm margin of normal adrenal tissue, across the body of the gland, leaving about 3 cm of residual left adrenal gland (Figures 2 and 3). The adrenal vein was left intact. Total operative duration was 210 minutes, with minimal blood loss. Her postoperative recovery was uneventful and she was discharged from hospital on the 4<sup>th</sup> postoperative day, while being maintained on hydrocortisone 30 mg and fludrocortisone 0.1 mg daily. The histopathology findings revealed bilateral cortical adenomas with the left tumour measuring 2 cm while the right tumour was 2.5 cm. There was no evidence of malignancy or hyperplasia in an otherwise normal adrenal gland.

Follow-up 1 month after surgery revealed a normalized blood pressure. The Synacthen test for cortisol showed normal results of 15 nmol/L and her ACTH level was

< 2 pmol/L, indicating a cured state. Her medication dosages were gradually decreased to fludrocortisone 0.05 mg daily and hydrocortisone 20 mg daily.

One year after surgery, she remained normotensive and her weight was reduced to 46.7 kg (BMI, 20.5). Most of her previous Cushingoid features resolved except for the abdominal striae. Serum cortisol levels remained low (9 nmol/L), whereas renin and aldosterone levels were normal. At 2-year follow-up, her cortisol levels had increased but were still subnormal (56 nmol/L), while ACTH and electrolytes were normal. The patient was maintained on a reduced daily dose of fludrocortisone (0.05 mg) and hydrocortisone (10 mg).

## Discussion

A single adrenocortical adenoma accounts for about 10–20%<sup>1</sup> of cases of Cushing's syndrome. In contrast, bilateral Cushing's adenomas are rare and reports are sparse.<sup>2</sup>

In our report, a patient who presented with Cushingoid features was diagnosed with ACTH-independent Cushing's syndrome on biochemical testing and abdominal CT scan detected bilateral adrenal tumours. Three possibilities can explain this setting: (a) bilateral cortisol hyper-functioning tumours, (b) unilateral cortisol-secreting tumour and contralateral nonfunctioning tumour or functioning tumour, e.g. aldosteronoma, pheochromocytoma, virilizing tumour or (c) bilateral macronodular adrenal hyperplasia. To distinguish these conditions adequately, adrenal venous sampling (AVS) by catheterization was performed. AVS, commonly performed in conditions of primary aldosteronism for tumours < 1.5 cm on CT imaging, is accurate in the preoperative localization of the source of abnormal hormone secretion. It is, however, an invasive procedure and failure to catheterize the adrenal veins occurs in 10–30% of cases.<sup>3</sup> Some have suggested that <sup>131</sup>I-methylnorcholesterol scintigraphy may be helpful, but it is no longer available in many centres, including ours. The AVS in this case was successful in showing that both adenomas were secreting cortisol.

Laparoscopic adrenalectomy has been accepted as the gold standard procedure for benign adrenal tumours not larger than 6–8 cm, since the first successful reported case by Gagner et al.<sup>4</sup> Several surgical treatments for bilateral adrenal tumours have been described. First is the conventional approach of bilateral total adrenalectomy for Cushing's syndrome and other adrenal conditions.<sup>5</sup>

Though the recurrence rate after this procedure is low, the patient requires lifelong steroid supplementation with glucocorticoids and mineralocorticoids. Second is bilateral total adrenalectomy with autotransplantation of an adrenal graft into muscle (e.g. sartorius, rectus abdominus) for vascularization of the graft.<sup>6</sup> One report describes the graft to be functioning well after 11 years without remission<sup>7</sup> whereas other reports have not supported the use and feasibility of adrenal autotransplantation.<sup>8</sup> The third approach is partial or cortical-sparing adrenalectomy. This has been done by both the open approach and the minimally invasive approach, mostly described for benign bilateral pheochromocytomas.<sup>9</sup> Several studies have shown a low rate of recurrence in these procedures as well as complete avoidance of steroid usage.<sup>7</sup> Laparoscopic partial adrenalectomy has been found to be effective and safe in bilateral tumours < 3 cm in diameter and situated in the periphery of the gland.<sup>10,11</sup> It has been described that at least a third of the normal functioning adrenal gland should be preserved for sufficient adrenocortical function, even if the main adrenal vein has been divided.<sup>12</sup> However, it is best, as much as possible, to preserve the main adrenal vein in most instances. The recurrence rate has been reported to be low.<sup>9–11</sup> However, very few studies have shown the feasibility of partial adrenalectomy for bilateral Cushing's adenoma since no long-term follow-up has been described.

Our patient lost 15 kg in weight. She was cured of her hypertension and is currently on low-dose steroids. The long delay of functional recovery is probably due to atrophy of the normal adrenal tissue as a result of chronic suppression by the hypercortisolism state. The recovery of function by the remaining adrenal tissue is likely to require more than several months and the tapered discontinuation of the replacement therapy is necessarily slow. The dose of replacement glucocorticoid therapy immediately after partial adrenalectomy and for several weeks afterwards is considerably greater than the physiological replacement, because the previous exposure to high levels of cortisol leads to a dependence upon glucocorticoids which is difficult to relieve.<sup>13</sup> Hence, continuous monitoring of the adrenal function is warranted to check for serum cortisol and ACTH.

This report has provided evidence that laparoscopic partial adrenalectomy is feasible in bilateral Cushing's adenoma, a rare condition. It has also shown that AVS is an important tool for determining the functioning status

and lateralization of the tumours. Long-term follow-up is recommended to monitor the extent of steroid replacement after surgery.

## References

1. Lacroix A, Bourdeau I. Bilateral adrenal Cushing's syndrome: macronodular adrenal hyperplasia and primary pigmented nodular adrenocortical disease. *Endocrin Metab Clin North Am* 2005;34:441-58.
2. Tung SC, Wang PW, Huang TL, et al. Bilateral adrenocortical adenomas causing ACTH-independent Cushing's syndrome at different periods: a case report and discussion of corticosteroid replacement therapy following bilateral adrenalectomy. *J Endocrinol Invest* 2004;27:375-9.
3. Young WF, Stanson AW, Thompson GB, et al. Role for adrenal venous sampling in primary aldosteronism. *Surgery* 2004;136:1227-35.
4. Gagner M, Lacroix A, Prinx RA, et al. Early experience with laparoscopic approach for adrenalectomy. *Surgery* 1993;114:1120-5.
5. Watson RGK, van Heerden JA, Northcut RC, et al. Results of adrenal surgery for Cushing's syndrome: 10 years of experience. *World J Surg* 1986;10:531.
6. Hardy JD. Surgical management of Cushing's syndrome with emphasis on adrenal transplantation. *Ann Surg* 1978;188:290.
7. Barzilai D, Dickstein G, Kanter Y, et al. Complete remission of Cushing's disease by total bilateral adrenalectomy and adrenal auto transplantation. *J Clin Endocrinol Metab* 1980;50:853-6.
8. Ledingham JGG, Nabarro JDN, Le Quesne LP. Adrenal auto grafts in the treatment of Cushing's syndrome caused by adrenal hyperplasia. *Br J Surg* 1966;53:1057.
9. Nambirajan T, Leeb K, Neumann HP, et al. Laparoscopic adrenal surgery for recurrent tumours in patients with hereditary pheochromocytoma. *Eur Urol* 2005;47:622-6.
10. Iihira M, Suzuki R, Kawamata A, et al. Adrenal-preserving laparoscopic surgery in selected patients with bilateral adrenal tumors. *Surgery* 2003;134:1066-73.
11. Imai T, Kikumori T, Shibata A, et al. Laparoscopic bilateral adrenalectomy for Cushing's syndrome due to ACTH-independent macronodular adrenocortical hyperplasia. *Biomed Pharmacother* 2002;56(Suppl 1):120-5.
12. Brauckhoff M, Thanh PN, Dralle H, et al. Functional results after endoscopic subtotal cortical-sparing adrenalectomy. *Surg Today* 2003;33:342-8.
13. Hawn MT, Cook D, Deveney C, Sheppard B. Quality of life after laparoscopic bilateral adrenalectomy for Cushing's disease. *Surgery* 2002;132:1064; discussion 1068-9.